



Governance issues related to the management and conservation of mangrove ecosystems to support climate change mitigation actions in Indonesia

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ABSTRACT

Mangrove ecosystems in Indonesia show great promise in contributing to climate change mitigation, but they continue to experience significant degradation primarily because of aquaculture conversion. This work analyzes the mangrove governance in Indonesia and how it fits the country's high emission reduction. The study is mainly based on the analysis of existing regulations, interviews with relevant stakeholders, focus group discussions, and series of executive lectures from high-level government officials. Results indicate overlapping authority claims by government institutions stemming from the absence of strong regulations specifically dedicated to mangrove management and conservation. Different government institutions have varied philosophical conceptions and development priorities for sustainably managing and conserving mangroves. This study identifies specific operational regulations that potentially undermine synergies across institutions for mangrove ecosystems. The conflicting regulations relate to coastal reclamation activities, management of mangroves in non-forest zones, and expansion of commercial aquaculture. In addition, several emerging policies, which are anticipated to further encourage ecosystem degradation, are discussed. This work then provides recommendations that can be adopted to foster an improved management and conservation of mangrove ecosystems, with the far-reaching aim to support the country's goals to reduce its carbon emissions. These recommendations include improved orchestrations of policy priorities of different institutions, including the active participation of local communities in the protection and conservation of mangroves.

1. Introduction

The 21st session of the Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) held in 2015 in Paris called for the commitments of countries to reduce their national emissions, framed within the Nationally Determined Contribution (NDC), to mitigate climate change and adapt the associated impacts (UNFCCC, 2016). In its NDC, the Government of Indonesia has committed by 2030 to reduce emissions unconditionally by 29% and conditionally by up to 41% with financial support from international parties. It further sets the largest emission reduction target for the forestry sector of 59.6% and 60.5% for the unconditional and conditional scenarios, respectively (Ministry of Environment and Forestry

[MoEF], 2019).

The potential forest-related actions, which must be taken to achieve the NDC targets, may include emission reductions from mangrove ecosystems, peatlands, and drylands (Griscom et al., 2017; Zeng et al., 2021). Mangroves are significant carbon sinks that store carbon that is three times that stored by other ecosystems; they are also equipped with essential ecosystem functions for climate mitigation and adaptation (Kauffman et al., 2020). Studies have concluded that Indonesia's mangrove forests show great promise in contributing to global climate change mitigation and helping achieve the country's NDC (Donato et al., 2011; Murdiyarto et al., 2015). The protection of one million hectares of mangrove forests in Indonesia can help achieve ~5.4% of the country's NDC (Zeng et al., 2021). More specifically, should mangrove

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deforestation be prevented, the total emissions can be reduced by 10%–31% of the annual emissions of the land use sector (Murdiyarso et al., 2015).

Despite the high potential of mangrove protection and conservation, the Indonesian NDC has yet to fully recognize its values and still emphasizes dryland and peatland ecosystems. The loss of pristine mangroves has been very rapid (Murdiyarso et al., 2015; Ilman et al., 2016). The location of mangroves between oceans and land has made institutional arrangements unclear. In addition, regulations related to mangrove protection and conservation are not yet defined at operational levels. The lack of strong institutions and regulations governing mangroves in Indonesia is seen as “two blades.” On the one hand, this issue can lead to unclear boundaries of the resource system and to the continued damage of mangrove ecosystems. Rotich et al. (2016) showed that weak mangrove governance in several countries has led to ecosystem deforestation because of the lack of enforcement and implementation by clear agencies with established mandates. This gap results in weak cross-sectoral coordination and encourages conflicts and competition among different agencies. On the other hand, it can eliminate sectoral boundaries; therefore, collaborative sustainable mangrove management (e.g., the addition of forestry to integrated programs), is supported (Giessen and Krott, 2008; Bong et al., 2016).

This policy paper aims to contribute to the ongoing policy discussions on the conservation of mangrove ecosystems to support climate change mitigation actions in Indonesia. It was mainly based on regulatory analysis complemented with the analysis of scientific publications, gray literature, government policies, and strategic planning documents. It was complemented with interviews involving relevant stakeholders. Furthermore, our viewpoint benefited from a series of executive lectures from government officials from different ministries/institutions and leading mangrove scientists. The findings were further calibrated through a series of focused group discussions on regulatory barriers. These discussions involved multiple stakeholders from central, provincial, and district governments; agencies; academia and scientists; private sectors or associations; and civil society organizations.

In the following section, we describe mangrove resources and ecosystems in the country, including the extent of the resources, uses and management, and degradation. Thereafter, we focus on the regulatory frameworks and institutional arrangements governing the mangrove ecosystems in Indonesia. We also discuss the near absence of regulatory frameworks specifically dedicated to mangrove management and conservation in Indonesia. Finally, we propose a range of policy recommendations with the goal of improving the management and conservation policy for mangroves in the future.

2. Mangrove ecosystems in Indonesia and their utilization and degradation

Indonesia has the largest mangrove cover in the world (Donato et al., 2011; Alongi, 2015), accounting for up to half of Asia's mangroves (Banjade et al., 2017). The total area of mangroves in Indonesia reaches 3.3 million ha, approximately three quarters of which are gazetted as forest zones and with the remaining dedicated to non-forest uses (*Areal Penggunaan Lain/APL*) (MoEF, 2020).

Mangrove ecosystems play an important protection/conservation role and show high economic potential. Mangroves protect coastlines from various disturbances, such as tsunamis, cyclones, and other natural hazards that potentially damage coasts (Alongi, 2014). As previously mentioned, mangrove ecosystems are also crucial for climate change mitigation, with avoided mangrove impacts contributing to 10%–31% of the annual emission reduction from land use sectors in Indonesia (Murdiyarso et al., 2015) or 8% of Indonesia's emission reduction targets (Arifanti et al., in press). Mangroves also produce various high-value products (timber and non-timber forest products), provide food sources for local communities, and potentially serve as ecotourism sites (Kusmana, 2018). The products from mangroves have been utilized by

local communities for years at a small scale for firewood, charcoal, housing materials, and fishing gears, as well as several other non-timber products (e.g., tannin, medicinal products, and saps) (Kusmana and Sukristijiono, 2016).

However, mangrove ecosystems in Indonesia face enormous threats from commercial aquaculture practices, rampant wood harvests, industrial development, mining, and settlement development (Richards and Friess, 2016), thereby leading to massive degradation and conversion. Over the past three decades, Indonesia has lost 25%–40% of its mangroves primarily because of commercial aquaculture development (Murdiyarso et al., 2015; Ilman et al., 2016). The conversion of mangroves into aquaculture has resulted in significant (mainly below-ground) carbon emissions (Arifanti et al., 2019). Initially occurring in Java and Sumatra, the establishment of commercial shrimp ponds rapidly spread across the country starting in 1970 (Ilman et al., 2016). The end of the 1990s saw a massive degradation of mangrove deforestation in Indonesia when the government promoted the development of large-scale water ponds triggered by the sharp increase of shrimp prices during the Asian financial crisis (Ilman et al., 2016). Accelerated mangrove deforestation is anticipated as the government has planned further aquaculture expansion to boost exports of fisheries commodities, especially shrimp (Salminah & Alviya, 2019).

3. Institutional arrangements and regulatory frameworks

Mangrove governance in Indonesia is fragmented, having been shaped by the interplays between tenure arrangements and use systems. In general, mangroves in Indonesia are divided into two main zones according to territorial mandates: forest zones, which are administered by the MoEF; and non-forest zones (also called *Areal Penggunaan Lain/APL*), which are linked to the Ministry of Agrarian and Spatial Planning (MoASP) and Ministry of Maritime Affairs and Fisheries (MoMAF). At the subnational levels, each of the ministries is associated with the sectoral services of the provincial and district governments (Fig. 1). The MoASP and local governments are particularly empowered to administer APL lands through spatial planning and regional planning (*Rencana Tata Ruang dan Wilayah*).

In early 2021, institutional arrangements for mangroves became increasingly complex with the establishment of the Peat and mangrove Restoration Agency (*Badan Restorasi Gambut dan mangrove/BRGM*), previously known as the Peat Restoration Agency (*Badan Restorasi Gambut*), at the national level. The BRGM is specifically tasked to coordinate with national government agencies involved in the implementation of peatland and mangrove restoration. It is specifically mandated to accelerate the rehabilitation of mangroves with a target area of 600,000 ha in nine provinces by 2024, as stated in the 2020–2024 National Medium-Term Development Plan.

In terms of regulatory frameworks, the mandates and tasks of the different bureaucracies follow their respective regulatory frameworks (sectoral laws). In many cases, they tend to overlap with one another (Table 1). The cross-level power differentials have also hampered cross-level coordination for integrated management directions (Di Gregorio et al., 2019). Over the past three decades, in the absence of synchronized intersectoral regulations, the different bureaucracies have pursued their own policy goals and priorities. For example, local governments may have plans to expand pond areas for fisheries by clearing mangroves, but the MoMAF is tasked to maintain these mangrove areas for conservation purposes. As Peters (2010) stated, bureaucratic institutions usually compete over mandates and laws to be able to expand their resources, power, and authority in the form of funding and staff. Cases of bureaucratic competitions for budgetary and functional gains are widespread, and they include the case of mangrove management and conservation (see Khan and Giessen, 2021).

It was only a decade ago that the central government began to provide a relatively coordinated direction for the institutional and regulatory frameworks for mangrove management and conservation. As

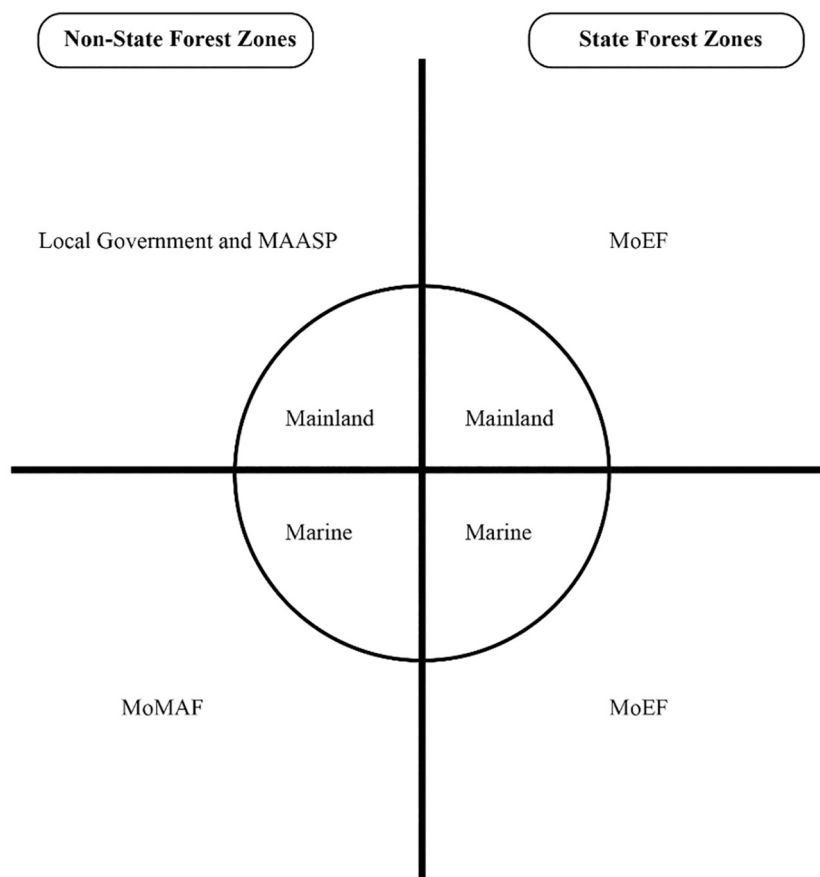


Fig. 1. Jurisdictional mandates of mangrove ecosystems in Indonesia.

Table 1
Mangrove governing institutions and mandates.

Institution	Task and Responsibility	Legal Basis
Ministry of Environment and Forestry (MoEF)	Protect and manage mangroves in state forest zones	Law No. 5/1990, Law No. 41/1999, Law No. 32/2009
Minister of Marine Affairs and Fisheries (MoMAF)	Manage mangroves in coastal and small island areas	Law No. 27/2007
Ministry of Agrarian and Spatial Planning (MoASP)	Enforce tenure rights and conduct spatial planning in nonstate forest zones	Law No. 5/1990, Law No. 26/2007
Ministry of National Development Planning (MoNDP)	Prepare the national strategy for mangrove ecosystem management	Decree of the National Development Planning Agency No. 89/2020
Peatland and mangrove Restoration Board (BRGM)	Coordinate stakeholders at varying levels associated with the implementation of mangrove restoration	Presidential Regulation No. 120/2020
Local Governments	Manage mangroves at the site level	Law No. 23/2014

stipulated in Presidential Regulation No. 73/2012, a National Coordinating Team for Mangrove Ecosystem Management was established, and it consisted of a coordinating /steering team and an implementation team Fig. 2. The former was chaired by the Coordinating Minister for Economic Affairs and comprises the Minister of Home Affairs, the Minister of Finance, the Minister of Environment, the Minister of Public Works, and the Head of the Ministry of National Development Planning (MoNDP). The latter consisted of the Minister of Forestry (which is now the MoEF) and the MoMAF.

However, no concrete action was implemented in the next five years.

Hence, in 2017 the Coordinating Ministry for Economic Affairs issued Regulation No. 4/2017 to respond to the continued high rates of mangrove conversion. It specifically targeted the restoration of 3.49 million ha of mangroves by 2045. The ministerial regulation mandated the MoEF, MoMAF, and MoASP to develop criteria for mangrove ecosystems as protected areas or cultivation areas and formulate norms, standards, procedures, and criteria (*Norma Standar Prosedur Kriteria/NSPK*), which regulate the mechanisms for mangrove conservation. However, the institutional arrangements and structures of the National Coordinating Team for Mangrove Ecosystem, as stipulated in Presidential Regulation No. 73/2012, became irrelevant to the ministerial structures of the current presidential cabinet. At present, the MoEF and MoMAF (as the implementing bureaucracies) are under the coordination of the Coordinating Ministry for Maritime and Investments Affairs instead of the Coordinating Ministry for Economic Affairs, which was tasked under the regulation to provide steering capacity. Therefore, the technical ministries (e.g., the MoEF and MoMAF) have continued to pursue their respective policy priorities and directions.

In 2020, the President of the Republic of Indonesia annulled Presidential Regulation No. 73/2012 and replaced it with Regulation No. 82/2020, which was later revised in Presidential Regulation 108/2020 (Fig. 3). The new regulation is aimed at simplifying the bureaucracies governing mangrove utilization. It has implications for the dissolution of the National Coordinating Team for Mangrove Ecosystem Management. Nonetheless, the MoNDP has issued Minister Decree No. 89/2020, which mandates the establishment of a (new) strategic coordinating team for wetland management. An interesting part of this regulation is the linkage to the Sustainable Development Goals, which allow this regulation to be active in 10 years, and the linkage to the Low Carbon Development Indonesia. This new regulation draws a new hope for the protection of Indonesia’s mangroves, including the achievement of the country’s NDC

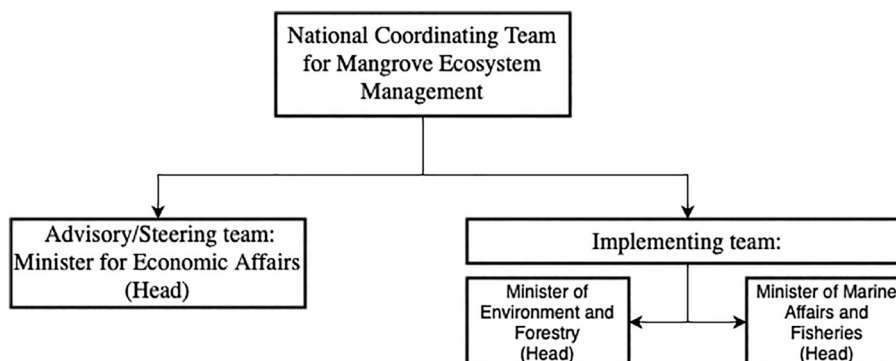


Fig. 2. Structures of National Coordinating Team for Mangrove Ecosystem Management.

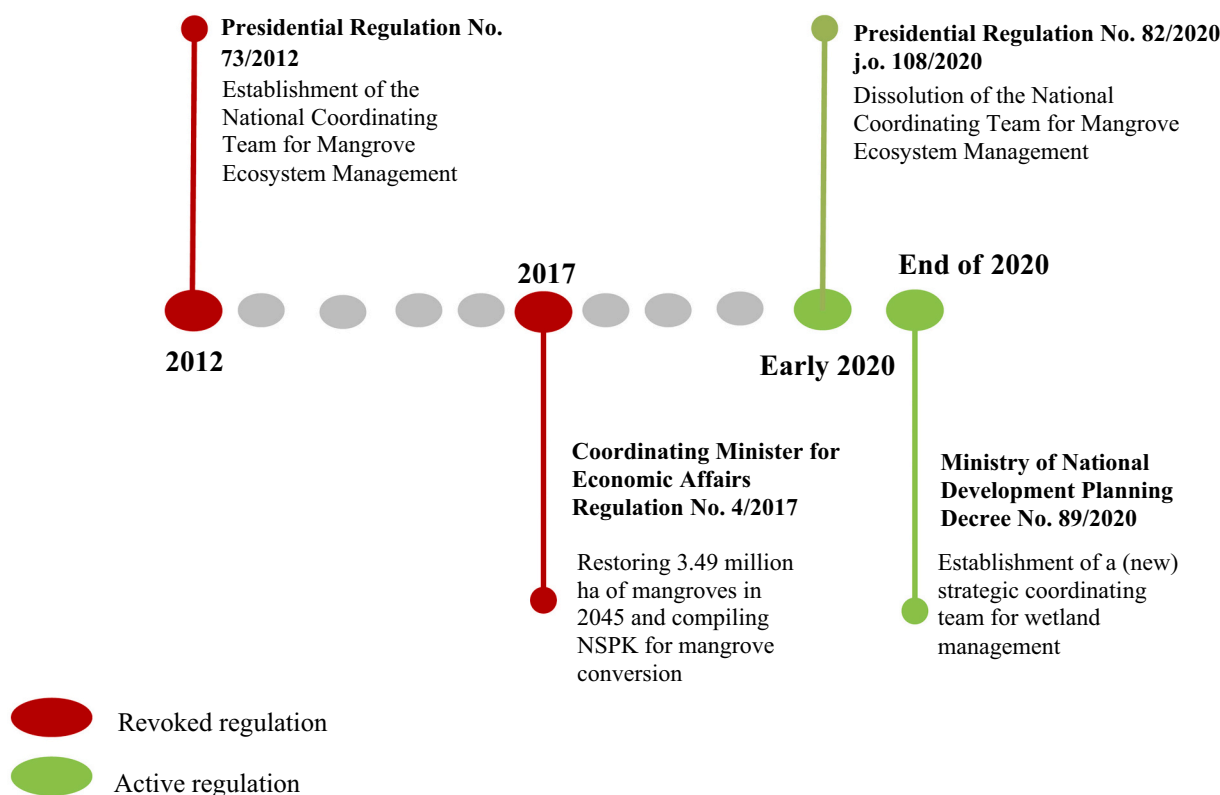


Fig. 3. Timeline of synchronized mangrove governance in Indonesia.

targets.

4. How complex institutional arrangements and regulatory frameworks turn out

4.1. Multiple conceptions of protection and conservation zones

The “protected area” conception adopted by the MoEF follows the philosophical approach and definition adopted by the International Union for Conservation of Nature. The definition generally emphasizes the ecological characteristics of an ecosystem. By contrast, the basic concept of “protected area” and “cultivation area,” as stipulated in Regulation No. 1/2018 of the MoASP, is highly influenced by the conception of spatial patterns, which generally classify space into two main uses/functions, namely, protection and cultivation; it emphasizes land use allocation and designs and puts forward multiscale and multisectoral perspectives (Scott et al., 2013) (Table 2).

Meanwhile, as stipulated in Regulation No. 23/2016, the MoMAF uses terms “conservation zone” and “public use zone,” which are equivalent to the terms “protected area” and “cultivation area,” respectively. The term “conservation area” is defined as “an area that has certain characteristics as an integrated ecosystem that is protected, preserved, and used in a sustainable manner” (The MoMAF Regulation No. 31/2020). The classification of conservation zones, as adopted by the MoMAF, mimics the national park model of the MOEF’s conservation forests. Nonetheless, in contrast to MoEF’s strict prevention of human intervention, the MoMAF still allows human interventions (including utilization) on conservation zones.

The MoMAF further classifies its conservation zones into three types, namely, parks, reserves, and maritime conservation areas. The first two areas are gazetted for the protection, preservation, and utilization of biodiversity and/or fish resources. Maritime conservation areas are dedicated to the protection, preservation, and utilization of traditional cultural sites. The permits for human interventions in conservation

Table 2
Different conceptions of conservation and protection of forests/zones.

	Bureaucracy		
	MoEF	MoASP	MoMAF
Term	Conservation zones	Protected areas	Conservation zones
Legal basis	Forestry Law No. 41/1999	MoASP Regulation No. 1/2018	MoMAF Regulation No. 23/2016
Function	Dedicated to the protection and maintenance of biological diversity and natural and associated cultural resources	Protects environmental sustainability, which includes natural resources, artificial resources, and historical and cultural values of the nation in the interest of sustainable development	Parks and reserves: Gazetted for the protection, preservation, and utilization of biodiversity and/or fish resources Maritime conservation areas: Gazetted for the protection, preservation, and utilization of traditional cultural sites.
Location (space)	State forest zones	Non-state forest zones (land)	Non-state forest zones (coastal)

zones, as adopted by the MoMAF, generally follow concepts of marine spatial planning that are based on ecosystems and place or areas. Ecosystem-based concepts indicate balancing ecological, economic, social, and cultural goals and objectives for sustainable development and the maintenance of ecosystem services. Place or area-based concepts put pressure on people who can understand, relate to, and care about marine spaces (Ehler, 2018).

4.2. Regulatory misfits

The multiple conceptions of protection or conservation areas as laid out in the different regulatory frameworks have led to complexities in operationalization. Several operationalizing regulations potentially encourage the further degradation of mangrove ecosystems and hinder rehabilitation activities. In general, the regulatory misfits relate to the use of mangroves in non-forest zones, centering around management regimes for mangroves (conservation, protection, utilization) and related requirements. The principal contexts of management regimes include coastal reclamation and commercial fishponds and shrimp cultures that are currently being pushed by central and local governments.

Following the decentralization policy, as stipulated by laws Nos. 22 and 25/1999, local governments have had considerable authority for natural resource management. Although its authority over forest zones has been reduced considerably (through Law No. 23/2014), local governments continue to have strong power over other natural resources, including the protection and utilization areas in non-forest zones (APL), which comprise mangrove ecosystems. In many regions, they continue to facilitate the increasing land cultivation requirements of local communities that also occur in mangrove-protected zones (Kusuma et al., 2016; Surur, 2017). To regulate the use of mangrove-protected zones for cultivation, the MoASP has issued Regulation No.1/2018 for guiding the spatial utilization distribution. The regulation specifies the Strategic Environmental Assessment (*Kajian Lingkungan Hidup Strategis*/KLHS).

However, several local governments continue to overlook the spatial planning requirements (Suryadi, 2019). The indicative (low-scaled) maps, as prescribed in KLHS, are inadequate to reflect the actual uses on the ground, thereby leading to inconsistencies and overlapping land uses. More important, the regulation of the MoMAF (No. 31/2020) does not list mangroves as a protected ecosystem/habitat, thus leading to the continued use of mangroves for extractive activities. In addition, the regulation still specifies “wise utilization activities” in conservation areas without prescribing detailed conservation norms and principles.

4.3. Emerging policy agendas with potential adverse impacts

Unsustainable practices in mangroves may be further encouraged by the recent government policy priorities on land distribution (agrarian reforms) and social forestry (Rahayu et al., 2020). As specified in the MoEF’s Regulation No. 17/2018, an intact mangrove forest is included as land gazetted for agrarian reform (*Tanah Objek Reforma Agraria*) and can be cultivated by local communities for non-conservation uses. Potential adverse impacts, including the release of carbon stored in mangrove ecosystems, are anticipated given the increasing coastal reclamation in recent years (Slamet et al., 2020). Several government regulations (e.g., MoMAF Regulation No. 25/2019 and Government Regulation No. 27/2021) stipulate that development activities can be conducted in conservation areas, thereby putting mangrove ecosystems under intense pressure.

Further pervasive unsustainable practices on mangrove ecosystems can also be anticipated with the recent central government policy encouraging additional job creations, as stipulated in Job Creation/Omnibus Law No.11/2020. This law formally aims to simplify and synchronize sectoral regulations. Although the law prohibits the harvest of mangroves, it exempts mangrove uses for fisheries as long as they meet conservation rules without clear operationalization. Thus, the law is widely considered to encourage the further expansion of commercial fish/shrimp ponds. Specifically, the law is aimed at fostering economic investments by simplifying procedures in obtaining business permits.

In fact, the MoMAF has a grand plan to revitalize and rejuvenate ponds in shrimp and milkfish production centers with the far-reaching aim to increase aquaculture production. The Ministry has targeted to increase fish production to 10.32 million tons and shrimp export growth by 8% per year by the end of 2024. As such, the permits for establishing commercial ponds are now only processed through a single gate within the MoMAF instead of 21 gates in previous complex bureaucratic processes. Without proper and prudent verification, the relatively simple licensing process is anticipated to encourage the further degradation of mangrove ecosystems.

5. Conclusions and policy recommendations

Mangroves are important ecosystems to support the efforts to halt the rising Earth temperatures and climate change as they store more carbon than other terrestrial ecosystems. The extensive mangrove resources of Indonesia can thus be pivotal for the country to achieve its ambitious target of emission reduction. However, the roles of mangrove ecosystems in climate change mitigation have yet to be fully integrated into the country’s NDC. Mangrove ecosystems continue to experience rapid degradation from expansive commercial activities, such as wood harvests, commercial water pond establishment, and coastal reclamation.

The rapid degradation of mangrove ecosystems in Indonesia can be associated with the absence of strong and clear regulatory frameworks dedicated to protection and conservation. The increasing economic values of these ecosystems have encouraged different government institutions from the central and local levels to stake a claim on resources and implement their own policy priorities and management concepts, which are often overlapping and even conflicting. Cases of mangrove deforestation driven by overlapping institutional settings and regulatory frameworks also occur in other countries (see Ishtiaque and Chhetri, 2016). Conflicts of interest are thus created across institutions, and they highlight the importance of intersectoral coordination.

In support of the country’s climate change mitigation strategies, policies on mangrove resources should be directed toward the prevention of the degradation of intact mangroves and the rehabilitation of degraded ecosystems. Institutions related to mangrove utilization, management, and conservation should be synchronized by strong regulatory frameworks overcoming sectoral boundaries. Wise use and management, including protection and conversion, must also be mainstreamed across different institutions. To overcome sectoral egos, the

uses and management of mangroves can be guided by a sustainable landscape approach, which is implemented by prioritizing multifunctional and multistakeholder principles, transparency, clarity of rights and responsibilities, and participatory monitoring (Sayer et al., 2013). Doing so can be crucial for overcoming the overlapping and conflicting interests in mangrove resources. The government has outlined its targets to rehabilitate 600,000 ha of mangrove ecosystems by 2024. Such rehabilitation requires a strong coordination of related government institutions. Specifically, they must develop a common understanding of the concepts of mangrove rehabilitation, make a clear division of rehabilitation locations, and implement joint monitoring activities.

Regarding the unclear jurisdictional authorities over mangrove ecosystems, the government should further consolidate and implement its recent policy on essential ecosystem areas (*Kawasan Ekosistem Esensial/KEE*), which represent a new category of conservation areas in mangrove ecosystems. The policy would open new avenues for forest protection outside state conservation areas, especially in wetlands (mangroves). In several regions, such as West Kalimantan, East Java, and Bangka Belitung, KEE initiatives have begun to emerge with the approval of local governments (USAID, 2019). Currently, no specific and clear guidelines and operational/implementing regulations exist to govern the KEE policy at the national level.

Local governments are also important in fostering the protection and conservation of mangroves in non-forest zones. They should be encouraged to elaborate their spatial plans, along with a clear designation of protection/conservation and utilization areas on the basis of the improved implementation of the KLHS. Local governments must also synchronize them with the plans of central government institutions. Local communities should be encouraged to adopt wise utilization approaches, which also consider environmental principles. Such principles include the promotion of silvo-fishery and ecotourism as alternative livelihood strategies to the currently extractive and degrading economic activities. Importantly, local communities should be actively involved in mangrove management so as to minimize human disturbance and thereby achieve the sustainable use of mangrove resources. Furthermore, community-based mangrove management must be encouraged.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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